Forensic Oceanography

Addendum to the "'Report on the *Left-To-Die Boat*'"

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NEW SPATIAL ANALYSIS EVIDENCE ON "LEFT-TO-DIE BOAT" CASE - 18 JUNE 2013

1. Introduction

On 11 April 2012, we released our "Report on the Left-To-Die Boat", an investigation employing a wide range of emerging mapping and visualisation technologies, that aimed to shed new light on the case in which 63 people who died at sea while trying to flee the 2011 war in Libya. Today we are realising a series of new visualisations and spatial analysis that contribute to better understanding of the events.

2. The report

In what is referred to as the "left-to-die boat" case, the 72 migrants who fled Tripoli by boat in the early morning of 27 March 2011. The boat ran out of fuel and was left to drift for 14 days until they landed back on the Libyan coast. Despite the distress call they sent out via satellite telephone and despite the significant naval and aerial presence in the area due to the military intervention, the migrants were not rescued. The survivors further stated that they were flown over by two helicopters and encountered a military ship, all of which failed to avert their tragic fate. With no water or food on-board only nine of the passengers survived.

Our report focused specifically on the spatial analysis of the "left-to-die boat" case, combining the testimonies of the survivors with a wide range of data including Synthetic Aperture Radar (SAR) imagery, geospatial mapping, and drift modelling. Through its detailed reconstruction of what happened to this vessel and assessment of the involvement of a number of parties, our report contributed to other initiatives, in particular to the in-depth report by Senator Tineke Strik, Rapporteur for the Committee on Migration, Refugees and Population of the Parliamentary Assembly of the Council of Europe (PACE), and to a coalition of NGOs that, in the name of several of the survivors, filed a legal case against the French Army for non-assistance to people in distress at sea.

3. New evidence

Today, over one year after the release of our report and despite several legal procedures and official enquiries, there has been scarce advance in the disclosure of new evidence by the different states participating in the military effort in Libya. If the states participating in the military effort in Libya denied their involvement in this incident and failed to disclose the identity of the helicopters and ships encountered by the migrants, they did not provide any definite evidence allowing to prove that they had no knowledge of the migrants' distress or that their naval and aerial assets were not in the area. Only further disclosure will allow to shed light on these events. In its absence, we release in this Addendum new evidence that confirms and specifies the degree of military presence at one of the most decisive moments in the chain of events.

The new piece of evidence consists in the analysis of a newly acquired Synthetic Aperture Radar (SAR) image, taken in the early morning of the 04 April 2011, that is around the time we have determined as that of the encounter with the military vessel that abandoned the migrants to die. The technical expertise of this SAR image provided by Rossana Padeletti, GIS and Remote Sensing Specialist and consultant, recruited for us by GIScorps, demonstrates that there was considerable presence of vessels in the area surrounding the drifting migrants' vessel. If these were military vessels, to which state did they belong? If they were commercial vessels, under which flag were they sailing and to which company do they belong?

SAR ANALYSIS - 04 APRIL 2011

For this report, Rossana Padeletti, GIS and Remote Sensing specialist and consultant, provided analysis of a 04 April 2011 Radarsat-1 Synthetic Aperture Radar (SAR) image. Padeletti's analysis provides estimates of ship length and quantification of confidence for all returns considered probable vessels. The resolution of the Radarsat-1 data (ScanSAR Wide (SCW), beam mode (A) W1 W2 W3 S7), allows for detection of ship returns as of a length of 50 meters, nevertheless the confidence of detection is high (> 80 %) for ships 75 meters and longer. On 24 March 2011 the U.S. Department of Defense disclosed that 38 NATO ships were being deployed in the frame of the 2011 military intervention in Libya. 37 of 38 ships were above 75 meters in length.

The scene extends for about 540km x 540km, providing a unique overall maritime picture at the time. Padeletti detected 99 returns whose pixels are much brighter than surrounding sea. Of these, she determined that 21 were offshore installations (oil and gas platforms, wells, moored tanker). As such, 78 probable vessels were detected. There may have been further vessels present in the eastern side of the image, which however presented too much scattering and background noise to detect possible targets.

1

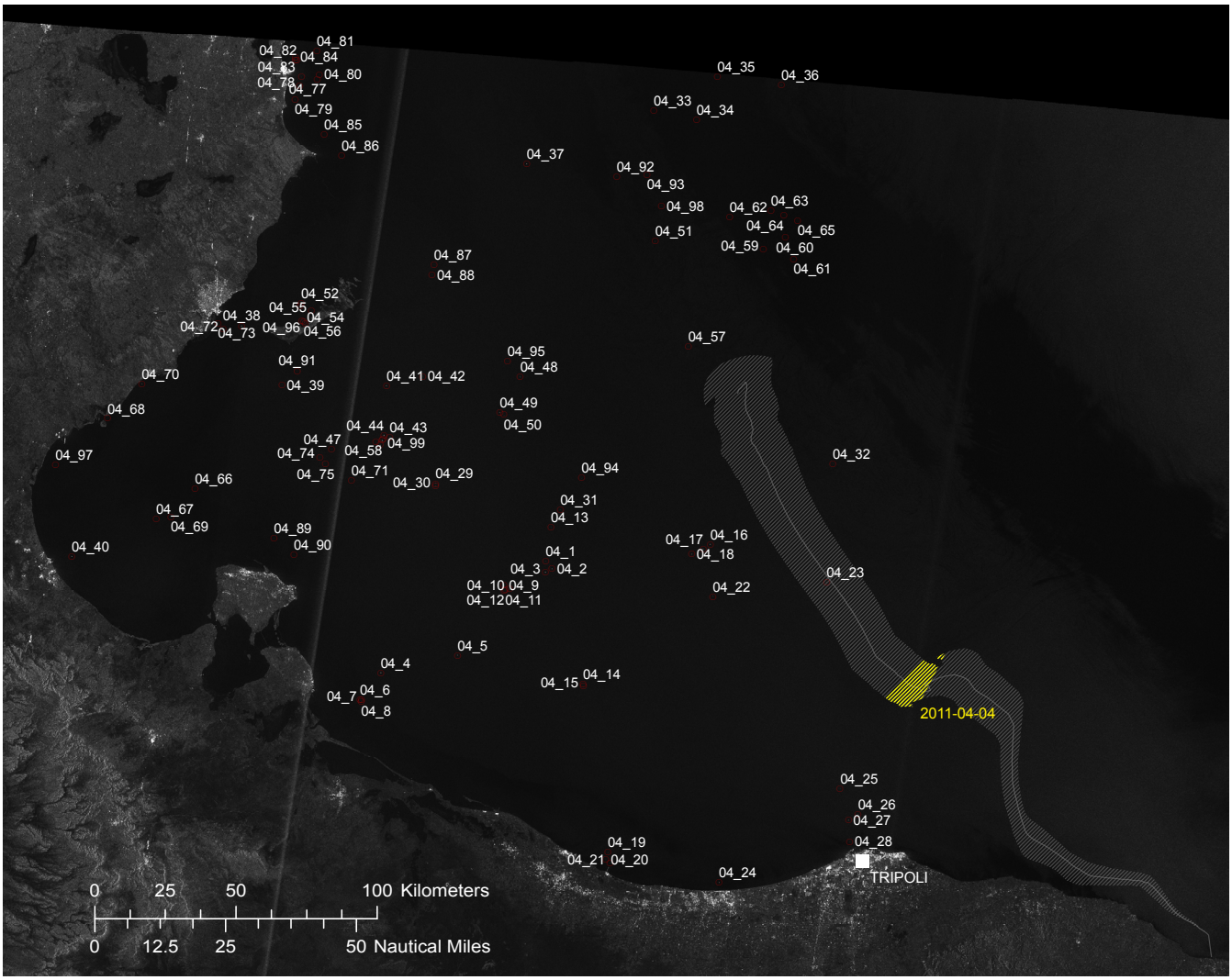


Fig. 1, Radarsat-1 data vessel detection for 04 April 2011 (full table of returns included in the Methodological Summary in annex)

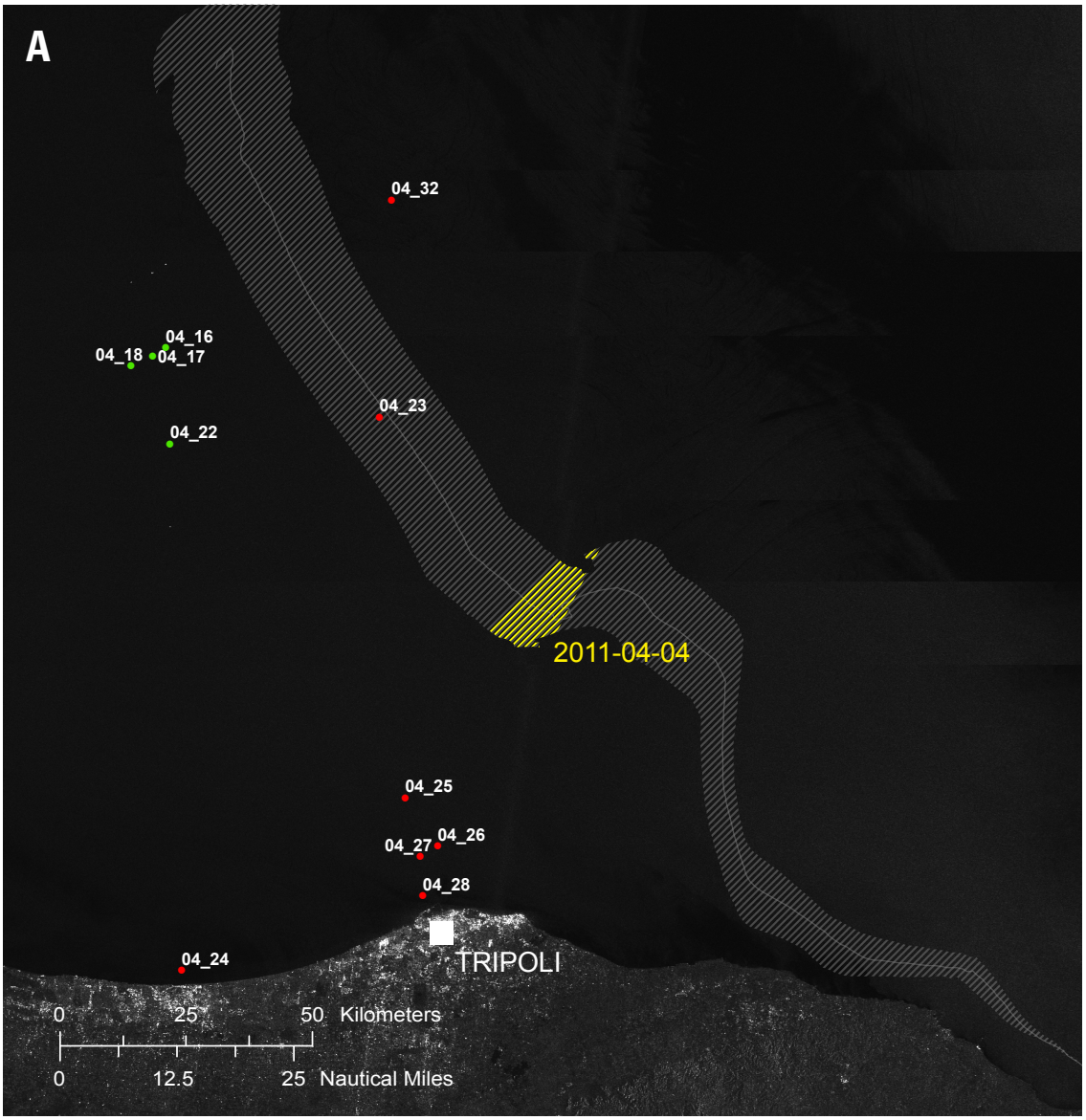
SAR ANALYSIS - 04 APRIL 2011 - CLOSE UP

The SAR image was taken on the 04 April 2011 between 5:08:42 and 5:10:08 AM (UTC). Based on the survivors' testimonies, we have determined that the encounter with a large military vessel that abandoned the migrants to their tragic fate occurred between the 03 and 04 of April, shortly before the night came, that is between 5 and 6 PM. As such the analysis of this SAR image demonstrates that there was a strong presence of vessels (certainly including military assets) around the drifting vessel 12-13 hours before or 11-12 hours after the encounter.

Observing the detected returns closest to the drifting boat, return 04_25 was 26.5 NM (49 KM) away, return 04_23 was 28.6 NM (53 KM) away, and return 04_32 was 47.5 NM (88 KM) away. These distances could have been covered by a military vessel in between 1 and 3h.

2

A



B

Return	Length metres	Confidence %
04_23	125	95
04_24	200	95
04_25	125	90
04_26	100	85
04_27	150	95
04_28	100	85
04_32	50	60

Fig. 2, Radarsat-1 data vessel detection for 04 April 2011 close up around the drifting vessel (A) with corresponding table of returns (B) documenting estimated length of vessel and confidence. Returns 04_16, 04_17, 04_18 and 04_22 are offshore installations (oil and gas platforms, wells, moored tanker).

METHODOLOGICAL SUMMARY

Analysis of 04-04-2011 Radarsat-1 ScanSAR Wide for ship detection

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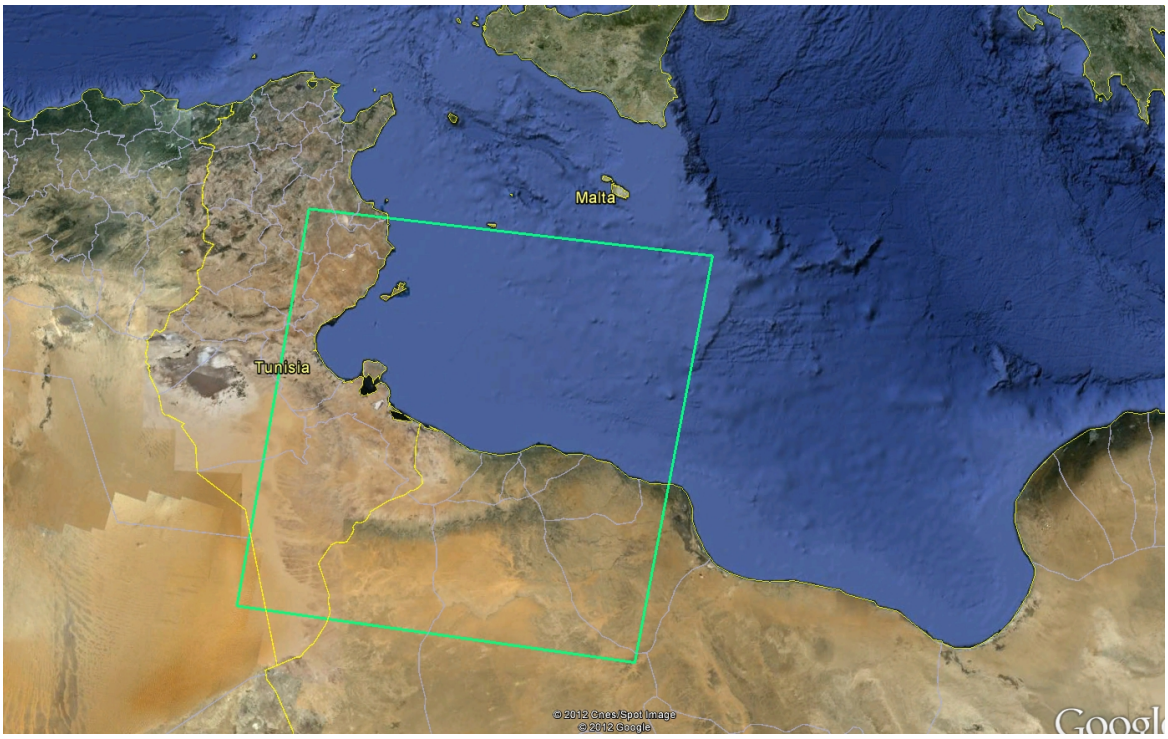
Image Description

The SAR image analyzed is a Radarsat-1 ScanSAR Wide (SCW), beam mode (A) W1 W2 W3 S7, 50 meters spatial resolution. It has been taken on April 4th, 2011 between 5:08:42 and 5:10:08 (UTC time)



Scene extension in GoogleEarth

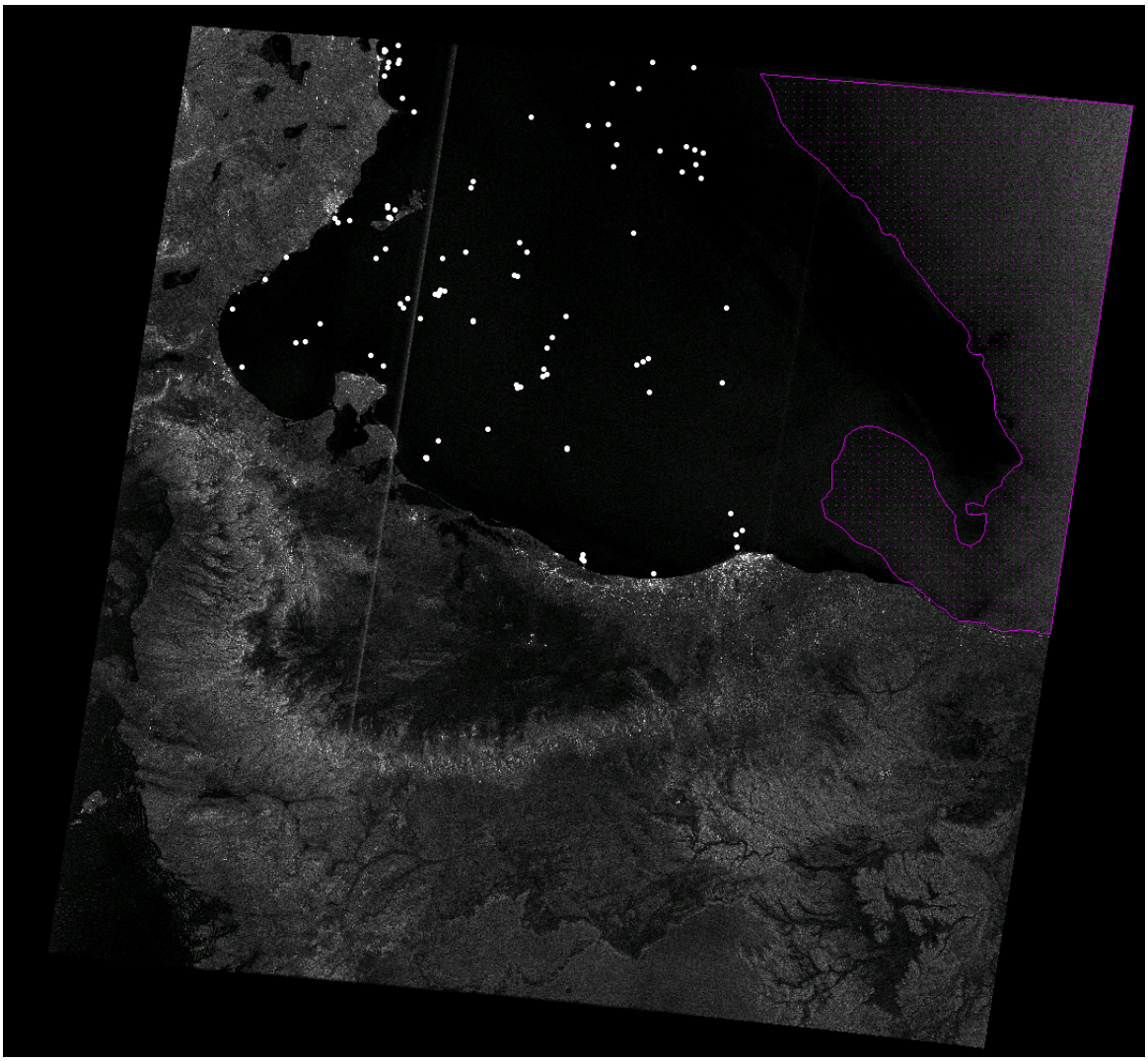
The scene extends for about 540 km x 540km, between UTM Zone 32 North and 33 North with corner coordinates:

35°04'09.91" N, 15°59'45.61" E	x: 15.99600278 y: 35.06941944
35°59'44.38" N, 9°54'38.83" E	x: 9.910786111 y: 35.99566111
29°59'19.12" N, 14°40'03.21" E	x: 14.66755833 y: 29.98864444
30°55'45.65" N, 8°55'27.85" E	x:8.924402778 y: 30.9293472

Analysis

For the purpose of the analysis the image has been flipped (east-west inverted) and projected in WGS84 UTM Zone 32 North.

Vessels could be detected due to medium image resolution, ships peculiar response to radar scattering that result in high brightness of pixels. The visual interpretation reported 99 returns whose pixels are much brighter than surrounding sea.



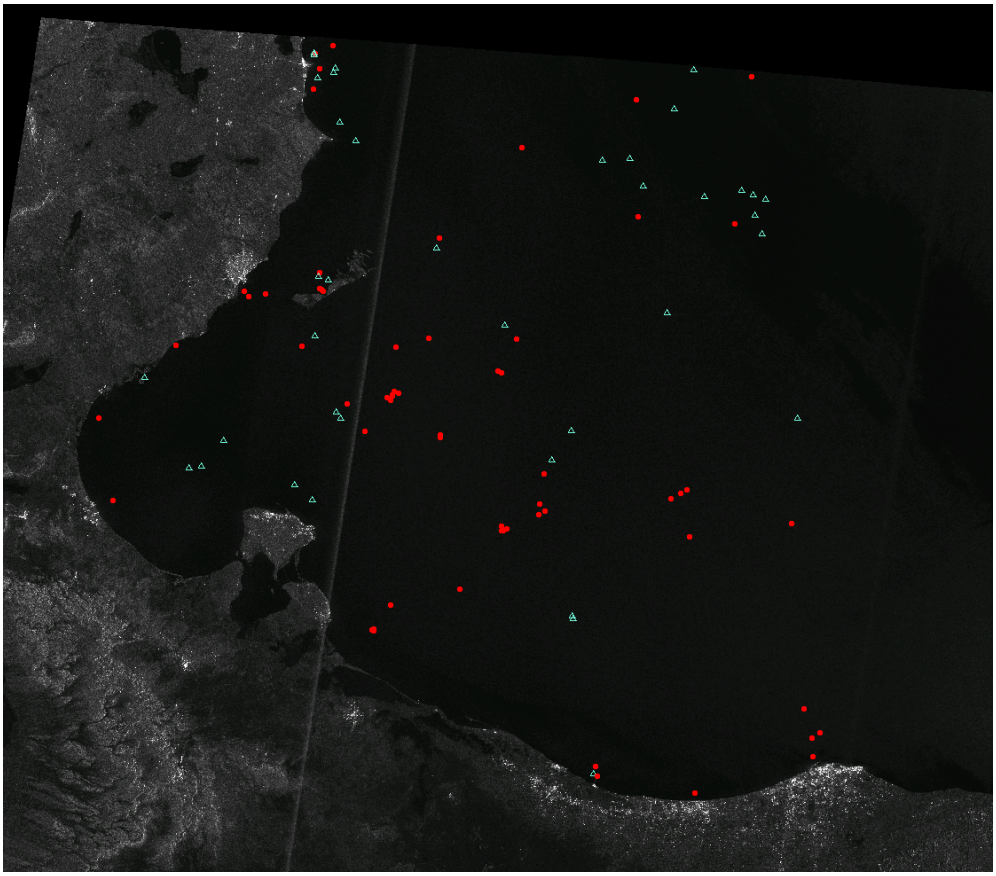
Possible returns identified (white spots). The dotted area on the east side represent the noise-disturbed area.

These targets are concentrated on the center and west part of the image.

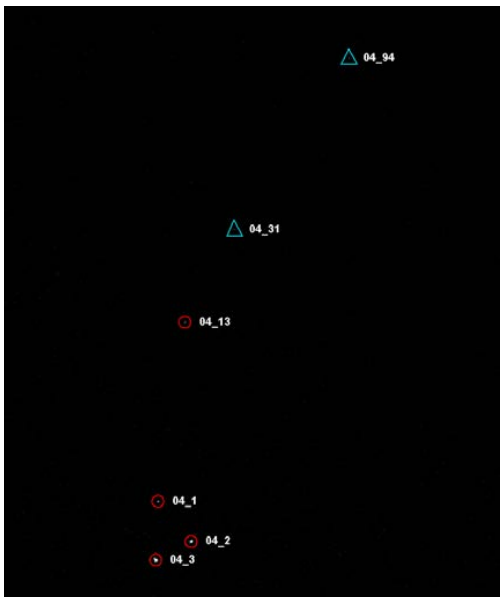
The east side presented too much scattering and background noise to detect possible targets.

The resolution of image also allowed for vessel length estimation.

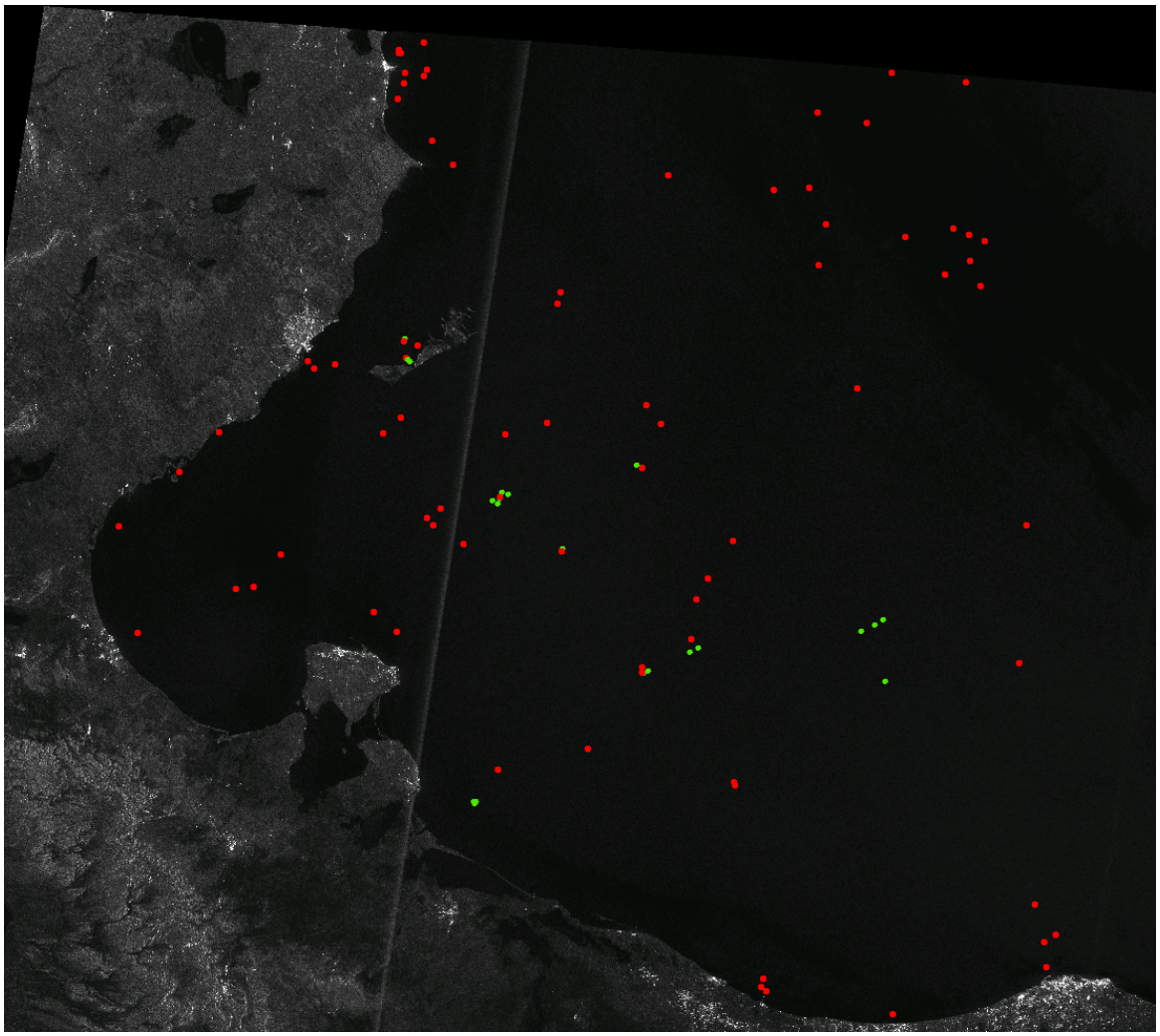
The minimum length for possible ship detection is 50 meters, nevertheless the confidence of detection is high (> 80 %) for ships 75 meters and longer.



The blue triangles (38 targets) represent low confidence ship detection, between 60 and 75%. The red points represent 61 targets with high detection confidence. Details below.



It was possible to discriminate with high confidence vessel targets from offshore installations (oil and gas platforms, wells, moored tanker). Offshore installations present irregular shapes and fixed position, their presence being verified through optical image comparison (Landsat ETM, freely downloadable at glovis.usgs.org.). A total of 21 OI were identified. Their distance to the coast has been calculated to the nearest point of the coastline with the *Near_analysis* tool of ArcGis.

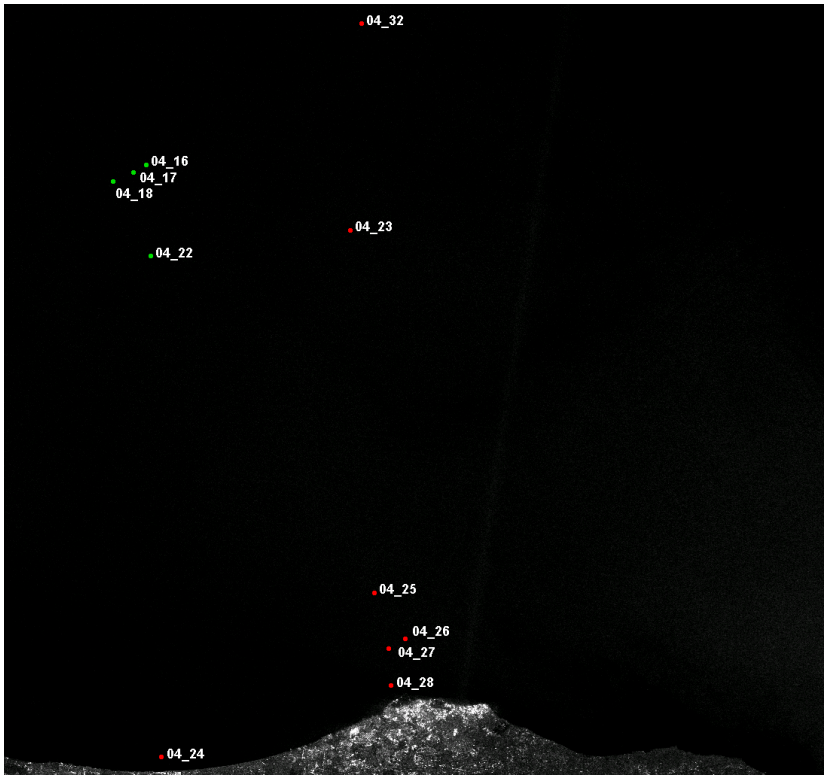


Green points indicate offshore installation, red points indicate vessels.

CODE	TYPE	NOTES	LENGTH meters	DISTANCE TO COAST kilometers	LONG	LAT
04_2	offshore installation	AL JURF PTF	125	87,57	12° 3' 31,51"	33° 51' 42,97"
04_3	offshore installation	FPSO TANKER_AL JURF FIELD	225	85,55	12° 1' 56,4"	33° 51' 4,32"
04_6	offshore installation	EL BIBANE OIL FIELD	50	15,71	11° 17' 44,65"	33° 26' 53,51"
04_7	offshore installation	EL BIBANE OIL FIELD	50	16,14	11° 18' 5,61"	33° 26' 54,38"
04_8	offshore installation	EL BIBANE OIL FIELD	75	15,69	11° 18' 0,42"	33° 26' 36,19"
04_10	offshore installation	DIDON PTF	100	75,84	11° 53' 25,39"	33° 48' 1,29"
04_11	offshore installation	FPSO TANKER_DIDON FIELD	250	74,29	11° 52' 24,81"	33° 47' 44,78"
04_16	offshore installation	BOURI DP3 PTF	150	120,37	12° 40' 52,73"	33° 55' 23,87"
04_17	offshore installation	BOURI FIELD SLOUG	400	117,64	12° 39' 10,54"	33° 54' 32,47"
04_18	offshore installation	BOURI DP4 PTF	200	113,83	12° 36' 25,12"	33° 53' 38,52"
04_22	offshore installation	SABRATHA PTF	150	104,78	12° 41' 0,48"	33° 45' 8,85"
04_29	offshore installation	HASDRUBAL GAS FIELD	100	61,65	11° 36' 40,33"	34° 8' 58,31"
04_43	offshore installation	ASHTART OIL FIELD	75	49,08	11° 26' 7,25"	34° 18' 19,69"
04_44	offshore installation	ASHTART OIL FIELD	100	47,49	11° 24' 46,15"	34° 18' 43,29"
04_45	offshore installation	ASHTART OIL FIELD	250	49,54	11° 23' 52,24"	34° 16' 50,1"
04_46	offshore installation	ASHTART OIL FIELD	75	47,74	11° 22' 51,37"	34° 17' 24,2"
04_49	offshore installation	MISKAR PTF	175	64,94	11° 52' 16,71"	34° 22' 39,8"
04_52	offshore installation	CERCINA OIL FIELD	100	5,84	11° 5' 51,31"	34° 44' 53,32"
04_56	offshore installation	CERCINA OIL FIELD	75	1,41	11° 6' 21,46"	34° 41' 23,04"
04_58	offshore installation	ASHTART OIL FIELD	350	48,66	11° 24' 18,83"	34° 17' 45,39"
04_96	offshore installation	CERCINA OIL FIELD	50	0,64	11° 6' 41,87"	34° 40' 57,28"

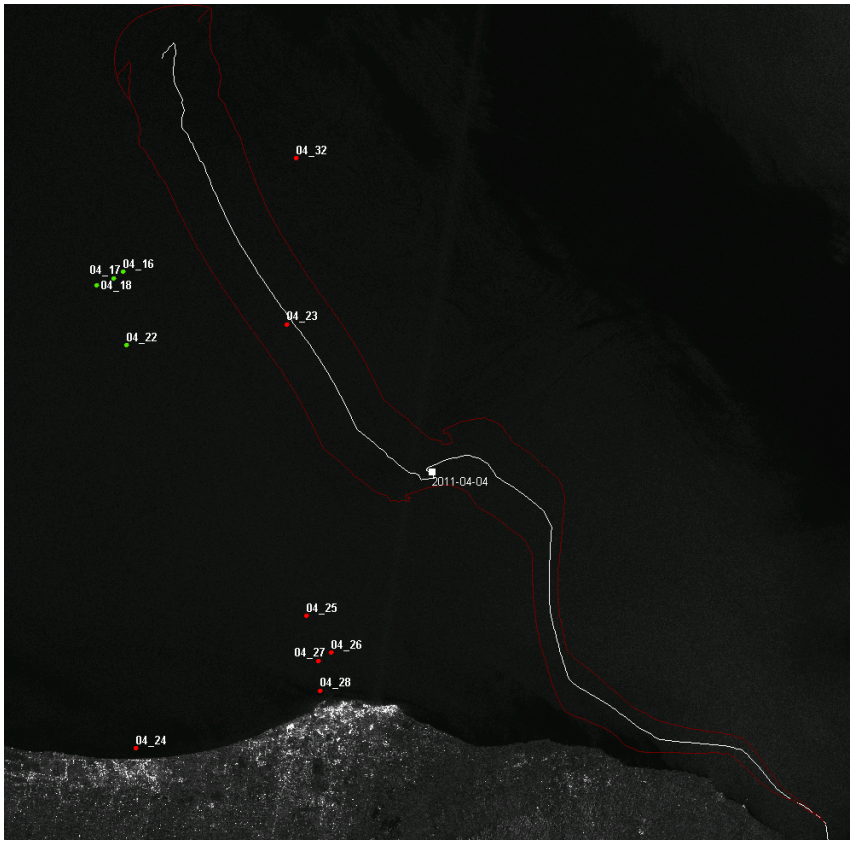
Estimated offshore installation

Targets closest to Tripoli



CODE	LENGTH meters	CONFIDENCE %	DISTANCE TO COAST kilometers	LONG	LAT	TYPE	NOTES
04_16	150	95	120,37	12° 40' 52,73"	33° 55' 23,87"	offshore installation	BOURI DP3 PTF
04_17	400	95	117,64	12° 39' 10,54"	33° 54' 32,47"	offshore installation	BOURI FIELD SLOUG
04_18	200	95	113,83	12° 36' 25,12"	33° 53' 38,52"	offshore installation	BOURI DP4 PTF
04_22	150	95	104,78	12° 41' 0,48"	33° 45' 8,85"	offshore installation	SABRATHA PTF
04_23	125	95	97,94	13° 7' 48,34"	33° 47' 12,13"	vessel	
04_24	200	95	2,78	12° 40' 7,41"	32° 49' 9,75"	vessel	
04_25	125	90	22,90	13° 9' 4,66"	33° 6' 37,99"	vessel	
04_26	100	85	12,72	13° 12' 58,5"	33° 1' 21,87"	vessel	
04_27	150	95	11,09	13° 10' 44,49"	33° 0' 20,3"	vessel	
04_28	100	85	3,37	13° 10' 51,1"	32° 56' 10,08"	vessel	
04_32	50	60	139,98	13° 10' 25,61"	34° 10' 13,29"	vessel	

Drift analysis

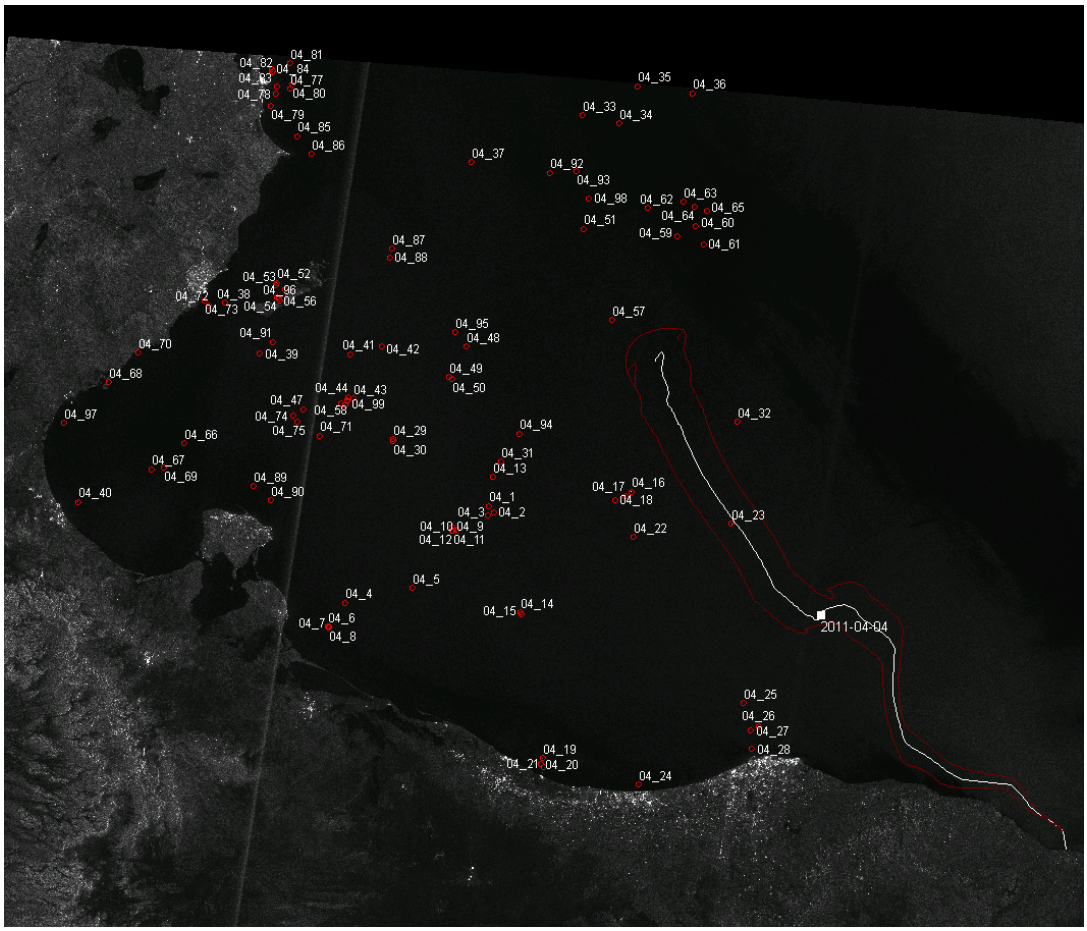


The vessel's drift model and targets closest to Tripoli area

After the integration of the vessel's drift model to the analysis, it has been possible to calculate the distance of the closest returns to the 2011-04-04 drift point, by applying the *PointDistance_analysis* tool in ArcGis:

TARGET CODE	DISTANCE TO 2011-04-04 DRIFT POINT kilometers
04_16	94,7187216
04_17	95,99860181
04_18	98,70513222
04_22	85,05645465
04_23	53,27656428
04_24	104,1032605
04_25	49,03814442
04_26	53,10998248
04_27	56,58145143
04_28	63,08432447
04_32	88,05141841

Complete table



CODE	LENGTH meters	CONFIDENCE %	DISTANCE TO 2011-04-04 DRIFT POINT kilometers	LONG	LAT	TYPE	NOTES
04_1	100	95	146,3517	12° 2' 6,88"	33° 53' 14,08"	vessel	
04_2	125	95	143,3622	12° 3' 31,51"	33° 51' 42,97"	offshore installation	AL JURF PTF
04_3	225	95	145,2957	12° 1' 56,4"	33° 51' 4,32"	offshore installation	FPSO TANKER_AL JURF FIELD
04_4	175	95	198,9502	11° 22' 42,9"	33° 32' 8,28"	vessel	
04_5	250	95	171,4538	11° 40' 46,47"	33° 35' 11,17"	vessel	
04_6	50	80	206,4204	11° 17' 44,65"	33° 26' 53,51"	offshore installation	EL BIBANE OIL FIELD

04_7	50	80	205,879	11° 18' 5,61"	33° 26' 54,38"	offshore installation	EL BIBANE OIL FIELD
04_8	75	90	206,0142	11° 18' 0,42"	33° 26' 36,19"	offshore installation	EL BIBANE OIL FIELD
04_9	100	95	158,6105	11° 52' 5,85"	33° 48' 44,3"	vessel	
04_10	100	95	156,2914	11° 53' 25,39"	33° 48' 1,29"	offshore installation	DIDON PTF
04_11	250	95	157,6713	11° 52' 24,81"	33° 47' 44,78"	offshore installation	FPSO TANKER_DIDON FIELD
04_12	75	90	158,1127	11° 52' 7,13"	33° 47' 44,89"	vessel	
04_13	75	85	148,9338	12° 3' 32,11"	33° 59' 48,88"	vessel	
04_14	50	60	125,563	12° 9' 57,53"	33° 28' 52,2"	vessel	
04_15	50	60	125,4075	12° 10' 2,4"	33° 28' 24,77"	vessel	
04_16	150	95	94,71872	12° 40' 52,73"	33° 55' 23,87"	offshore installation	BOURI DP3 PTF
04_17	400	95	95,9986	12° 39' 10,54"	33° 54' 32,47"	offshore installation	BOURI FIELD SLOUG
04_18	200	95	98,70513	12° 36' 25,12"	33° 53' 38,52"	offshore installation	BOURI DP4 PTF
04_19	100	85	131,0547	12° 14' 34,77"	32° 55' 44,4"	vessel	
04_20	50	60	132,9451	12° 14' 1,24"	32° 54' 22,29"	vessel	
04_21	75	90	132,1941	12° 14' 58,69"	32° 53' 40,18"	vessel	
04_22	150	95	85,05645	12° 41' 0,48"	33° 45' 8,85"	offshore installation	SABRATHA PTF
04_23	125	95	53,27656	13° 7' 48,34"	33° 47' 12,13"	vessel	
04_24	200	95	104,1033	12° 40' 7,41"	32° 49' 9,75"	vessel	
04_25	125	90	49,03814	13° 9' 4,66"	33° 6' 37,99"	vessel	
04_26	100	85	53,10998	13° 12' 58,5"	33° 1' 21,87"	vessel	
04_27	150	95	56,58145	13° 10' 44,49"	33° 0' 20,3"	vessel	
04_28	100	85	63,08432	13° 10' 51,1"	32° 56' 10,08"	vessel	
04_29	100	90	193,5882	11° 36' 40,33"	34° 8' 58,31"	offshore installation	HASDRUBAL GAS FIELD
04_30	75	90	193,292	11° 36' 37,48"	34° 8' 29,03"	vessel	
04_31	50	60	148,4321	12° 5' 51,62"	34° 3' 10,04"	vessel	
04_32	50	60	88,05142	13° 10' 25,61"	34° 10' 13,29"	vessel	
04_33	50	80	231,6719	12° 31' 13,44"	35° 20' 48,12"	vessel	
04_34	50	60	222,4819	12° 41' 16,42"	35° 18' 45,22"	vessel	
04_35	50	60	234,3581	12° 46' 41,27"	35° 27' 0,43"	vessel	

04_36	100	90	224,8372	13° 1' 53,27"	35° 24' 51,36"	vessel	
04_37	150	95	239,3214	12° 0' 22,3"	35° 11' 7,01"	vessel	
04_38	250	95	281,6265	10° 51' 32,62"	34° 40' 39,07"	vessel	
04_39	100	90	258,967	11° 0' 53,09"	34° 28' 56,22"	vessel	
04_40	250	95	314,5736	10° 10' 36,61"	33° 56' 2,35"	vessel	
04_41	150	95	225,1422	11° 25' 37,21"	34° 28' 25,83"	vessel	
04_42	125	90	215,4689	11° 34' 16,11"	34° 30' 4,51"	vessel	
04_43	75	95	215,5994	11° 26' 7,25"	34° 18' 19,69"	offshore installation	ASHTART OIL FIELD
04_44	100	95	217,7817	11° 24' 46,15"	34° 18' 43,29"	offshore installation	ASHTART OIL FIELD
04_45	250	95	217,5152	11° 23' 52,24"	34° 16' 50,1"	offshore installation	ASHTART OIL FIELD
04_46	75	90	219,3714	11° 22' 51,37"	34° 17' 24,2"	offshore installation	ASHTART OIL FIELD
04_47	75	85	233,1906	11° 12' 20,57"	34° 16' 11,22"	vessel	
04_48	125	95	186,1784	11° 57' 18,99"	34° 29' 27,69"	vessel	
04_49	175	95	184,8952	11° 52' 16,71"	34° 22' 39,8"	offshore installation	MISKAR PTF
04_50	75	90	183,0872	11° 53' 15,67"	34° 22' 7,39"	vessel	
04_51	125	95	189,7697	12° 30' 24,52"	34° 55' 11,86"	vessel	
04_52	100	95	266,8169	11° 5' 51,31"	34° 44' 53,32"	offshore installation	CERCINA OIL FIELD
04_53	50	60	266,6035	11° 5' 36,67"	34° 44' 21,44"	vessel	
04_54	75	95	263,4396	11° 5' 57,75"	34° 41' 35,26"	vessel	
04_55	50	60	262,3855	11° 8' 14,14"	34° 43' 30,79"	vessel	
04_56	75	95	262,7282	11° 6' 21,46"	34° 41' 23,04"	offshore installation	CERCINA OIL FIELD
04_57	50	60	151,1951	12° 37' 20,83"	34° 34' 17,06"	vessel	
04_58	350	95	217,6314	11° 24' 18,83"	34° 17' 45,39"	offshore installation	ASHTART OIL FIELD
04_59	75	85	169,6958	12° 56' 3,46"	34° 52' 47,9"	vessel	
04_60	50	60	171,0598	13° 1' 21,25"	34° 54' 54,06"	vessel	
04_61	50	60	162,7615	13° 3' 10,67"	34° 50' 39,93"	vessel	
04_62	50	60	185,0609	12° 48' 19,88"	34° 59' 20,25"	vessel	
04_63	50	60	182,1701	12° 58' 12,29"	35° 0' 24,29"	vessel	
04_64	50	60	178,9808	13° 1' 16,37"	34° 59' 18,91"	vessel	

04_65	50	60	175,8612	13° 4' 28,08"	34° 58' 14,31"	vessel	
04_66	50	60	275,8622	10° 39' 52,22"	34° 9' 1,82"	vessel	
04_67	50	60	286,8394	10° 30' 40,14"	34° 3' 11,48"	vessel	
04_68	50	60	313,5089	10° 19' 27,66"	34° 23' 1,08"	vessel	
04_69	50	60	281,8601	10° 34' 5,57"	34° 3' 32,13"	vessel	
04_70	225	90	305,933	10° 27' 42,62"	34° 29' 39,68"	vessel	
04_71	75	85	222,5796	11° 16' 49,52"	34° 10' 4,59"	vessel	
04_72	75	90	286,9896	10° 47' 11,69"	34° 40' 5,79"	vessel	
04_73	75	90	289,6642	10° 45' 58,6"	34° 41' 17,16"	vessel	
04_74	75	70	236,1554	11° 9' 30,71"	34° 14' 41,48"	vessel	
04_75	50	60	233,488	11° 10' 44,09"	34° 13' 20,48"	vessel	
04_76	75	80	317,5116	11° 7' 2,47"	35° 29' 22,82"	vessel	
04_77	50	60	312,8049	11° 10' 48,94"	35° 28' 50,1"	vessel	
04_78	100	70	315,6375	11° 6' 38,49"	35° 27' 37,57"	vessel	
04_79	100	80	313,5863	11° 5' 21,68"	35° 24' 58,53"	vessel	
04_80	50	60	313,5351	11° 11' 21,65"	35° 29' 48,53"	vessel	
04_81	75	80	320,3714	11° 10' 51,37"	35° 34' 29,15"	vessel	
04_82	75	80	322,9783	11° 6' 4,66"	35° 32' 44,5"	vessel	
04_83	75	70	323,9786	11° 5' 44,43"	35° 33' 13,65"	vessel	
04_84	100	75	323,3098	11° 5' 41,69"	35° 32' 41,31"	vessel	
04_85	50	60	297,0749	11° 12' 15,9"	35° 17' 58,48"	vessel	
04_86	50	70	287,39	11° 16' 17,2"	35° 13' 50,63"	vessel	
04_87	75	85	236,0127	11° 37' 41,6"	34° 51' 57,86"	vessel	
04_88	50	70	234,2702	11° 37' 5,77"	34° 49' 59,4"	vessel	
04_89	50	60	243,7042	10° 58' 16,84"	33° 59' 0,24"	vessel	
04_90	50	60	235,3118	11° 2' 55,4"	33° 55' 39,29"	vessel	
04_91	60	60	256,1524	11° 4' 32,47"	34° 31' 32,36"	vessel	
04_92	60	70	217,0503	12° 21' 44,68"	35° 8' 6,22"	vessel	
04_93	60	60	212,1369	12° 29' 0,54"	35° 8' 17,47"	vessel	

04_94	50	60	147,1406	12° 11' 9,43"	34° 9' 22,34"	vessel	
04_95	50	60	193,3234	11° 54' 27,89"	34° 32' 40,89"	vessel	
04_96	50	80	261,8706	11° 6' 41,87"	34° 40' 57,28"	offshore installation	CERCINA OIL FIELD
04_97	50	80	326,8786	10° 7' 3,96"	34° 14' 0,46"	vessel	
04_98	60	60	199,6327	12° 32' 13,83"	35° 2' 3,46"	vessel	
04_99	75	90	217,5494	11° 24' 25,93"	34° 17' 51,52"	vessel	